भारतीय मानक

IS 15942 (Part 2) : 2022

Indian Standard

वाटर पार्कों में सुरक्षा की अनुशंसित रीतियों की संहिता

भाग 2 सुरक्षा अपेक्षाएँ

(पहला पुनरीक्षण)

Code of Recommended Practice for Safety in Water Parks

Part 2 Safety Requirements

(First Revision)

ICS 97.220.40

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Continuous Bulk Conveying, Elevating, Hoisting Aerial Ropeways and Related Equipment Sectional Committee, MED 6

FOREWORD

This Indian Standard (Part 2) was adopted by the Bureau of Indian Standards, after the draft finalized by the Continuous Bulk Conveying, Elevating, Hoisting, Aerial Ropeways and Related Equipment Sectional Committee had been approved by the Mechanical Engineering Division Council.

This revision has been taken up to keep pace with the latest technological developments and international practices. This revision incorporates the following major changes:

a) New clauses **8** and **11** were added.

Although most of the safety parameters relating to safety have been covered in safety Codes relating to amusement rides, this Code covers general information and general requirements in order to guide the manufacturers, operators, and users.

The Code of recommended practice for safety in water parks is being brought out in three parts. The other parts of the series are as follows:

Part 1	General Information
Part 3	Instructions

The composition of the committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values’ (*second revision*). The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CODE OF RECOMMENDED PRACTICE FOR SAFETY IN WATER PARKS

PART 2 SAFETY REQUIREMENTS

(*First Revision*)

1 SCOPE

1.1 This Code (Part 2) is applicable to all water slides over 2 m in height from water level.

1.2 This Code is also applicable to types, not yet described in this Code provided the safety requirements are fulfilled.

1.3 This Code specifies general requirements for all types of water slides and accessories and specific requirements to defined types of water slides. These requirements are relating to safety, technical rules for design and calculation.

1.4 Nothing in this Code is intended to contravene the provision of any of the existing Codes/Specification and Government Regulation(s) applicable. Where existing Codes/Specifications/ Rules for a specific area exist they shall apply, if stricter. It is the responsibility of the user of this Code to establish appropriate safety and health practices and comply with regulatory and statutory requirements prior to using the water park pools.

2 TERMINOLOGY

For the purpose of this code, the following definitions shall apply.

2.1 Water Slide — Piece of equipment with an inclined sliding surface, down which the user descends by sliding usually under the influence of gravity and with water as the friction-reducing medium, either freely or with the use of ride enhancement devices, if so designed.

2.2 Platform — Area providing access to the start section.

2.3 Start Section — Area at which the user enters the slide properly.

2.4 Slide Proper — Area intended for sliding.

2.5 Final Part — Part of the slide proper with a downward inclination of less than 5 percent, designed to prepare the user for landing.

2.6 Catch Unit — Integral part of a water slide, not part of the slide proper, which brings the rider to a halt on the sliding surface.

2.7 Splash Down Area — Either a specific pool or an area that is part of a general-purpose pool, in which the rider is brought to a halt in the water.

2.8 Drop — Length of the slide proper, titled with an inclination greater than those of adjacent sections.

2.9 Tube — Closed section, not necessarily circular in cross-section, of a water slide, with a fully utilizable sliding surface.

2.10 Cover — Device, to enclose an open slide, not intended for sliding.

2.11 Riser — Extension for the slide proper, intended for sliding.

2.12 Wave Screen — Device, placed within the clearance zone, to control spilling water.

2.13 Ride Enhancement Device — Device to slide on or in, designed for a particular water slide.

2.14 Guardrail — A device to restrict users from falling over, under, or through it.

2.15 Average Inclination — Inclination calculated by the following formula:

$$x = (h \times 100)/l \text{ percent}$$

where:

h = height between start section and beginning of final part, in metres;
l = actual length of the slide proper excluding the final part, in meters.

2.16 Clearance Zone — Space around the slide proper, free from obstacles.

3 CLASSIFICATIONS

3.1 Type 1

Straight individual slide with an average inclination of maximum 70 percent not exceeding 3 m in height above water level and 2.70 m above ground.

3.2 Type 2

Individual slide with an average inclination between 10 percent and 18 percent, excluding the final part, not exceeding 3 m in height above water level and 2.70 m above ground.

3.3 Type 3

Individual slide, not restricted in height with an ‘In addition to the single component test, a test on an average inclination of maximum, 13 percent, excluding minimum of two adjacent elements joined together shall be carried out. The user can achieve an average speed of 5 m/s and a maximum speed of 7 m/s.

3.4 Type 4

Speed individual slide with an average inclination is determined by an engineering expert or recognized between 10 percent and 20 percent, excluding the agency by calculation and/or testing of the material/ final part. The user can achieve an average speed of the component used to construct the water slide. 10 m/s and a maximum speed of 14 m/s.

3.5 Type 5

High-speed individual slide with an average inclination of at least 20 percent, excluding the final part. The user can achieve a speed of more than 14 m/s.

3.6 Type 6

3.6.1 *Type 6.1*

Multi-track in the form of Type 3 with separate parallel tracks (straight or curved), one beside the other over the full length. The user can achieve an average speed of 5 m/s and a maximum speed of 7 m/s.

3.6.2 *Type 6.2*

Multi-track in the form of Type 4 with separate parallel tracks (straight or curved), one beside the other over the full length. The user can achieve an average speed of 10 m/s and a maximum speed of 14 m/s.

3.7 Type 7

Wide straight slide with a maximum inclination of 25 percent, not exceeding 8 m in height above water level and 7.7 m above the ground. The user can achieve a maximum speed of 7 m/s.

4 MATERIALS

Any material may be used for the construction of water slides, supports and ride enhancement devices provided it fulfills the requirements of this standard,

5 DESIGN LOADS

5.1 General

5.1.1 A certificate issued by the designer on the correct construction of the water slide and the way it is erected complies with all relevant standards/Codes and statutory laws (if any) must be available with the concerned agency.

5.1.2 The component tests should be carried out on slide sections of the same dimensions and design, with comparable supporting conditions and joints. In addition to the single component test, a test on a minimum of two adjacent elements joined together shall be carried out.

5.2 Dead Load

For every component of the slide, the dead load shall be determined by the designer of the concerned agency by calculation and/or testing of the material/component used to construct the water slide.

5.3 Water Load

For the purpose of calculation, the water load shall be twice the designed amount of water flowing on the slide. For the defined Types, taking into consideration the flow rate as given in **7.4**, the water load where the inclination is more than 5 percent shall be conventional as follows:

a) Type 1: Water load is too small to be taken into account
b) Type 2: 0.1 kN/m
c) Type 3 to Type 5 : 0.2 kN/m
d) Type 6: 0.1kN/m
e) Type 7: 0.2 kN/m

In case inclination is less than 5 percent, the real load of the water contained in the slide may be considered.

5.4 Load of Sliding Person

Measurements shall be as given in Table 1

In a curve, the centripetal acceleration generates a centrifugal force which act radially outward in the curve and which depend on the mass of the sliding person, the current sliding speed, and the radius of the curve, The loads from the centrifugal forces which are to be taken under Table I are calculated below by way of example.

Example:

Type of water slide : 5

Load of sliding person : 1.5 kN/m (vertical)

User speed, *v* : 16 m/s

Length of load application : 1 m (radial)

The radius of the curve, *r* : 11.0 m

Centripetal acceleration, *a* $= v^2/r = 16^2/11 = 23.28\ \text{m/s}^2 = 2.372\ \text{g} < 2.6\text{g}$(6.6.1)

5.5 Effects of impact

The effects of impact shall be considered in the start section, or where the drop is fitted.

Table 1 Measurements to be Considered
(*Clause* 5.4)

Sl. No.	Type	Load of sliding person kN/m	Length of load m	Conventional speed for calculation m/sec	User speed m/sec	Length of application m	Point of application Above bottom (see Fig 1)	Direction
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	1	0.8	-	-	-	-	-	-
ii)	2	0.8	5	3.5	3.5	5	0.1	Horizontal
iii)	3	1.5	5	7.0[2)]	3.5 7.1[2)]	5 1.0[2)]	0 0.1	Vertical Horizontal
iv)	4	1.5	1	12.0	12.0	1.0	0 0.35	Vertical Horizontal
v)	5	1.5	1	16.0	16.0	1.0	0 0.35	Vertical Horizontal
vi)	6.1	1.5	5	7.0[2)]	3.5[3)] 97.00	5.0[3)] 91.00[2)]	0 0.1	Vertical Horizontal
vii)	6.2	1.5	1	12.0[2)]	12.0	1.0	0 0.35	Vertical Horizontal
viii)	7	1.5 kN/m^2 0.5 kN	4) 5)	5.0	5.0	5.0	0	Vertical Horizontal

NOTES
1 Maximum acceleration on a sliding person *see* **6.6.1**
2 Single person.
3 Chain sliding.
4 Over the complete sliding surface.
5 Point load at the side of the slide

5.6 Stationary Persons

Loads of stationary persons shall only be taken into consideration where the inclination is less than 20 percent. In this case, the load shall be taken as 0.8 kN/m for Type 1 to Type 2 and 1.5 kN/m for Type 3 to Type 6.

For Type 7 the load for stationary persons shall be included in the load of the sliding persons which has to be calculated over the complete sliding surface.

5.7 Wind Load

The wind load for all types of water slides shall be calculated in accordance with the IS 875 (Part 3). If a slide is used in windy weather, a contemporary action of centrifugal force plus 30 percent of the maximum wind load shall be taken into account.

5.8 Snow Load

The snow load for all types of water slides shall be taken into consideration as per IS 875 (Part 4). For open slides, not in use during the winter, the snow load for the whole cross-section area shall be taken into consideration.

5.9 Temperature

For slides installed outdoors, the effect of mean temperature variations for the calculation of the longitudinal deformation of the slides shall be considered.

6 SAFETY REQUIREMENTS

6.1 General

6.1.1 Waterslides installed in the park should be treated as structures and attention is drawn to the statutory requirements (any Act/Local regulation in force) with regard to means of access and means of support.

6.1.2 Various risks can be involved in using a water slide, for example, ejection from the slide, impacts, falls, burns, entrapment. Following requirements shall be complied to reduce such risks and to be applied as appropriate:

a) Material and components shall not cause additional hazards taking into account the swimming pool environment.
b) If the special feature has been incorporated in the design, for example, special water effects, then the user shall be informed of the special feature and if any special precautions have to be observed.

c) It is a general safety recommendation that the user should remain in contact with the slide proper throughout its length unless made aware prior to use of the possibility of becoming involuntarily airborne.

6.2 Surfaces

6.2.1 Surfaces in reach by staff and the public should be protected or constructed in such a way as to prevent injuries. The surface within the clearance zone and shall have no apertures except those for water or specific features (see **7.5**).

6.2.2 Surface of the slide proper the surface of the slide proper shall form a smooth, continuous surface, free from irregularities; a difference in level is permitted where two elements are joined together but this shall not be against the sliding direction and should not cause discomfort to the rider. This surface includes the returns on the top edges.

6.3 Corners and Edges

Corners and edges within the clearance zone shall be rounded to a radius of at least 3 mm, and edges of cuts and holes should be suitably protected.

6.4 Access to Water Slides

6.4.1 General Access to water slides shall be constructed in accordance with IS 15492 (Part 2) and IS 15492 (Part 3); if stepladders are used they shall have handrails on both sides, which shall merge into the guardrail of the platform. Steps shall be flat.

6.4.2 Steps Corners and edges shall be rounded with a radius of at least 3 mm. The surface shall inhibit slipping. Testing shall be carried out in wet conditions.

6.4.3 At the end of the means of access there shall be platforms of at least 500 mm in depth in front of the entrance to the start section, to prevent users from falling backward. The platforms shall have guardrails of at least 1 000 mm in height. When the fall exceeds 12 000 mm, the guardrails shall be at least 1 200 mm in height. Their height shall be measured from the highest point on which a person can stand within 1 000 mm from the guardrails (*see* Fig. 1), they shall be designed in such a way as to prevent climbing.

6.5 Start Section

6.5.1 If a start section is not secured by the guardrails of a platform it shall have guardrails of the same height and characteristics as stated under **6.4.3**.

6.5.2 The start section shall be fitted with a seamless transition from the top of the guardrails to the sides of the slide proper in the sliding direction.

6.5.3 The start section shall be constructed in such a way that the user cannot be directly forced onto the slide proper by people coming from behind. This can be achieved by installing a raised start section or by interposing one step up between the access and the start section itself.

6.5.4 Except for Type 1, water slides shall have a crossbar situated 800 mm to 1 100 mm, above the surface of the slide between the start section and the slide proper. This is to prevent the user from entering the slide standing up and to aid the user in sitting down and sliding in accordance with the instructions.

6.6 Slide Proper

The top edges of both outer sides of a slide shall be made in such a way that in normal use the user cannot touch or reach the outer parts of the Slide. The individual components of the slide proper shall be arranged or designed in such a way that the slider is contained at all times within the slide and that his natural progression is safe.

6.6.1 Maximum acceleration on a sliding person the acceleration and its duration can have an influence on the users and the film of water on which they travel. In accordance with current experience acceleration and its duration should conform to Table 2.

Table 2 Gravitational Acceleration and Related Duration

(*Clause* 6.6.1)

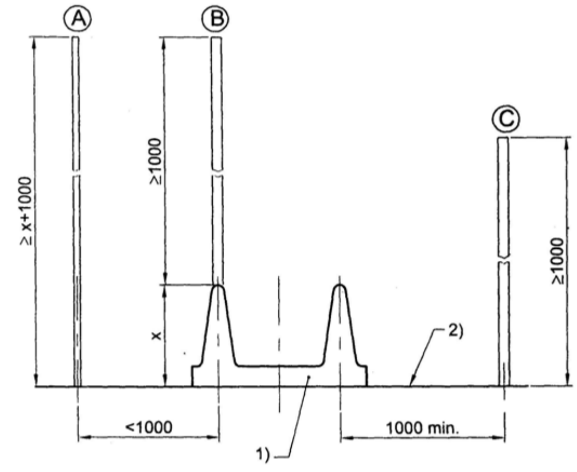
Sl. No.	**Acceleration** (g in m/s^2)	**Duration** (in sec)
(1)	(2)	(3)
i)	≤ 4	≤ 0.1
ii)	≤ 2.6	≥ 0.1

6.6.2 Tubes and Covered Sections Tubes and covered sections shall be constructed in such a way that the rider does not become disorientated (for example, slide partially or completely translucent). If a specific feature is foreseen which involves risk of disorientation or panic in a tube or a covered section (for example, a completely dark part, a shower, etc.), the user shall be notified before the means of access.

6.7 Final Part

6.7.1 *General*

The final part of the slide proper shall be designed to ensure a safe landing. This can be achieved if the user is slowed down and prepared for the Landing in a controlled position with particular attention to speed and awareness. Using available information on safety, a catching unit (*see* **7.2**) should be preferred; the second choice is a special pool (*see* **7.3.2**), and the third is a general-purpose pool (*see* **7.3.3**).



A, B, C are different possibilities for placing guardrails.

A = guardrail within 1 000 mm from a higher standpoint.

B = guardrail on a side of a start section.

C = guardrail outside 1 000 mm from a higher standpoint.

1) = start section platform.

2) = height of the highest point on which a person can stand.

(All dimensions in millimetres.)

FIG. 1 HEIGHT OF GUARDRAILS

6.7.2 *Splashdown Area*

A splashdown area may be used for every water slide, provided the user is slowed to at least the average speed of Type 4. If a splashdown area is used for a water slide not included in **3**, its dimensions shall be the same as for defined water slides with the same speed.

6.8 Means of Exit

6.8.1 If the slide ends in a pool, the exit up to floor level can be stepladders, stairs, or sloping bottom conforming to valid regulations. The exit path for users shall not interfere with the path of users of other slides.

6.8.2 If the final parts of slides enter the same side of a pool, the means of exit shall be on the opposite side of the pool to force the users to move forward and away from the paths of other users. Allowed positions for the exits are shown in Tables 4 to 6 read with the figure.

6.9 Entrapment

To prevent the risk of entrapment relevant requirements as per the relevant standard shall be followed.

6.10 Accessories

6.10.1 *Covers*

The inner surface shall be smooth and free from irregularities except for joints. Methods of fixing shall be constructed so as to prevent injury to the users.

6.10.2 *Ride Enhancement Devices*

Slides designed for use with ride enhancement devices should be safe:

a) To the user who becomes parted from his ride enhancement device; and
b) To users who can come into contact with the separated device.

Rides enhancement devices shall float when used in a splashdown pool. The edges shall be in accordance with **6.3**. The device shall be clearly marked for the specific body position, body weight, and body length it is designed.

If the ride enhancement device is not made of soft material (for example, inflatable or soft foam devices) spacing of the users is necessary to regulate the distance between them while sliding.

6.10.3 *Other Accessories*

6.10.3.1 Where a cover, a tube entrance, a wave screen, or a riser is fitted other than at the beginning of the slide, the sides of the slide shall have a smooth transition with a maximum angle of 45°, regarding the speed. Edges shall be radiused with a minimum radius of 100 mm.

6.10.3.2 The height of the entrance to the cover or tube shall be at least 1 200 mm as shown in Fig. 2

6.11 Water Supply

6.11.1 *General*

If water is taken directly from areas accessible to the public, special attention shall be paid to the safety problems caused by suction.

6.11.2 *Flow Rate*

As the flow rate of the water has an effect on sliding, it shall be defined by the supplier and fixed for each installation at the time of commissioning.

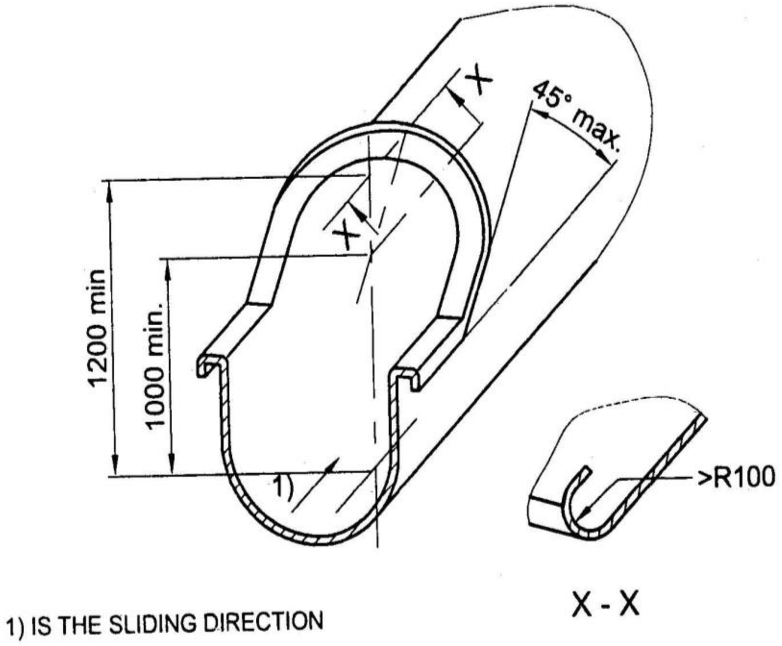
6.11.3 *Controlling System*

There shall be means of ensuring that interference with the water flow rate by an unauthorized person is eliminated. It is also recommended that an alarm device be installed which activates in the event of malfunction of water flow controls.

6.12 Interference between Users

6.12.1 The slide shall be designed and/or installed and equipped in such a way that interference between users (not sliding in a chain) is prevented. Interference between users can be caused by inappropriate spacing at the start and/or by significant differences in speed of the users caused by different sliding positions.

6.12.2 If difference sliding positions cause significant differences in speed, only one position (or a group of positions causing similar speeds) shall be allowed (for example, if sliding in a sitting position can bring the user to an involuntary stop, the allowed position shall be altered or restricted as shown in Fig. 2 or a distance control according to the situation has to be arranged).



All dimensions in millimetres.

FIG. 2 TRANSITIONS

6.13 Interference between Users and Non-Users

The slide shall be designed and/or installed in such a way that non-users cannot interfere with users in their clearance zones.

7 ADDITIONAL SAFETY REQUIREMENTS FOR TYPES 1 TO 7

7.1 Slide Proper

7.1.1 *Type 1*

The dimensions of the cross-section shall be in accordance with Fig. 3.

7.1.2 *Type 2*

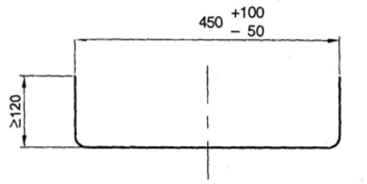
The dimensions of the cross-section shall be in accordance with Fig. 4 at least for the first 2 m after the start section, after which the dimensions can be enlarged up to the minimum dimensions of a cross-section of Type 3.

7.1.3 *Type 3*

The dimensions of the cross-section shall be in accordance with Fig. 5, except for tubes, which shall have an inner diameter between 900 mm and 1 400 mm.

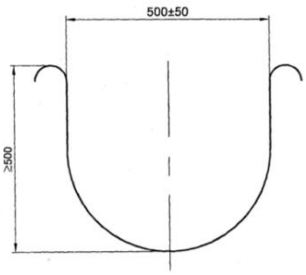
7.1.4 *Type 4*

The dimensions of the cross-section shall be in accordance with Fig. 5, except for tubes, which shall have an inner diameter between 900 mm and 1 400 mm. If a speed slide is not straight or is a tube, special attention shall be paid to the design of curves after a significant increase in speed.



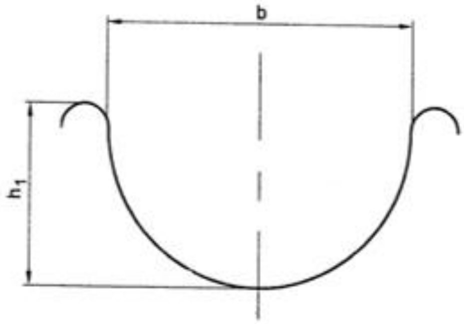
All dimensions in millimetres.

FIG. 3 CROSS-SECTION OF TYPE 1

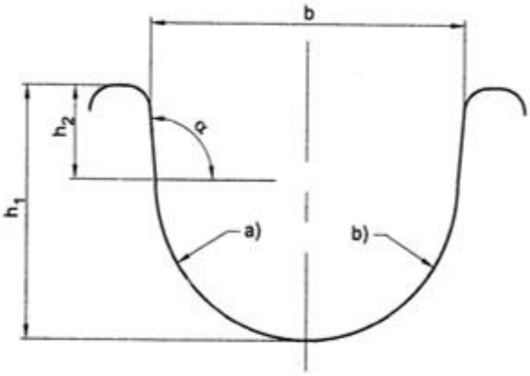


All dimensions in millimetres.

FIG. 4 CROSS-SECTION OF TYPE 2



STRAIGHT PART



$\alpha \leq 95^{\circ}$
$b \geq 900$ mm ≤ 1400 mm.
h_1 type 3 ≥ 600 mm.
type 4 ≥ 700 mm.
$h_2 \geq 200$ mm.
a) = outer curve.
b) = Inner curve.

FIG. 5 CROSS-SECTION OF TYPES 3 AND 4

7.1.5 *Type 5*

Straight slides with a curved bottom shall be in accordance with Fig. 6. Straight slides with a flat bottom shall be in accordance with Fig. 7. If the slide is not straight it shall be constructed as a tube of a minimum inner diameter of 800 mm and a maximum inner diameter of 900 mm.

7.1.6 *Type 6*

The dimensions of the cross-section of a straight slide shall be in accordance with Fig. 7

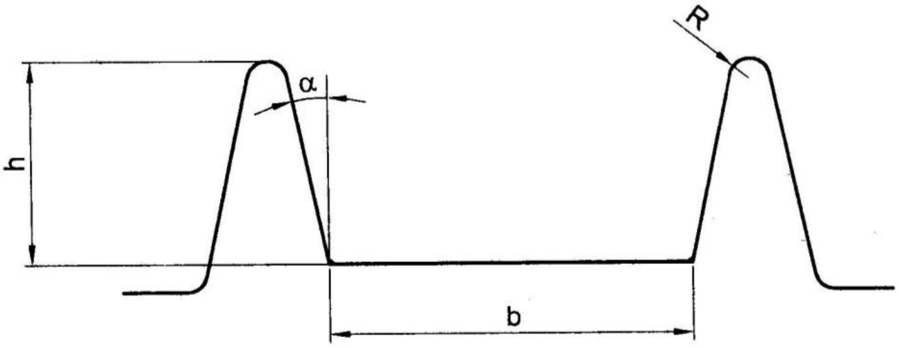
7.1.6.1 Curved multi-track of Type 6.1 shall have a cross-section conforming to Fig. 5 Type 3.

7.1.6.2 Curved multi-track of Type 6.2 shall have a cross-section conforming to Fig. 5 Type 4.

7.1.6.3 Straight multi-track can have a cross-section conforming to Fig. 6 or Fig. 7.

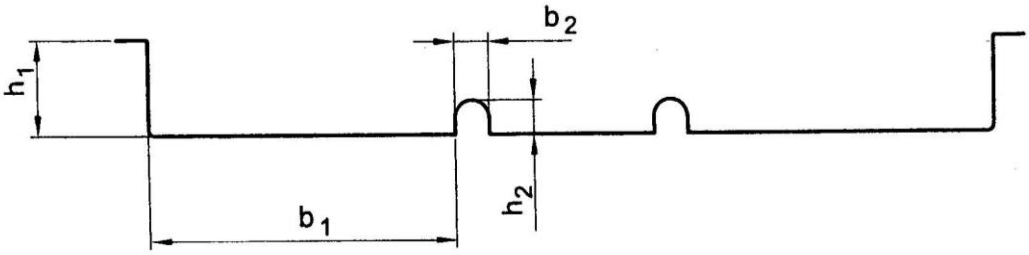
7.1.7 *Type 7*

The dimensions of the cross-section of a wide slide shall be in accordance with Fig. 8.



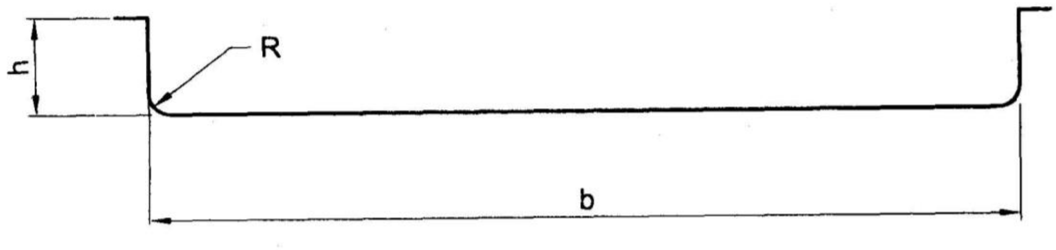
600 mm ≤ b ≤ 700 mm.
h ≥ 400 mm.
α ≤ 12°.
R ≥ 40 mm.

FIG. 6 CROSS-SECTION OF TYPE 5



600 mm ≤ b_1 ≤ 1 800 mm.
h_1 ≥ 500 mm.
b_2 ≥ 200 mm.
h_2 ≥ 200 mm.

FIG. 7 CROSS-SECTION OF TYPE 6, STRAIGHT



$2\ 000\ \text{mm} \leq b \leq 5\ 000\ \text{mm}.$

$h \geq 500\ \text{mm}.$

$R \geq 50\ \text{mm}.$

$h/_2 > R \geq 50\ \text{mm}.$

FIG. 8 CROSS-SECTION OF TYPE 7

7.2 Catch Unit

A catch unit should be preferred for Types 2 to 4 and shall be used for slides with a maximum speed higher than 14 m/s (for exceptions *see* **6.7.2**).

The catching unit shall be designed in such a way that:

a) The user is brought to a halt without coming into contact with the end of the unit; and
b) Users can have it safely and quickly.

7.3 Splashdown Area

7.3.1 General If the design of the final part is not in accordance with **2.5**, the water depth and dimensions of the splashdown area shall be adjusted to take account of the practical tests.

7.3.2 *Specific Pools*

7.3.2.1 The dimensions given in Tables 4 to 7 are recommended dimensions and can be varied depending on the actual installation and design, but under no circumstances shall the user, when splashing down, be able to reach the surrounding walls of the splashdown area or collide with users from adjoining slides.

7.3.2.2 In case of slides of Types 2 to 5 with final parts entering the same side of a pool and slides of Type 6, a centre line of contrasting colour for each lane shall be indicated on the pool's bottom, and/or soft floating lanes shall be used to lead users to their proposed exists. Minimum water depth for different falling distances is shown in Table 3. The pool's floor in the splashdown area shall be horizontal and free of irregularities.

7.3.3 General Purpose Pools Minimum water depth for different falling is shown in Table 3. The pool's floor in the splashdown area shall be free from irregularities.

7.3.4 *Falling Distance and Water Depth*

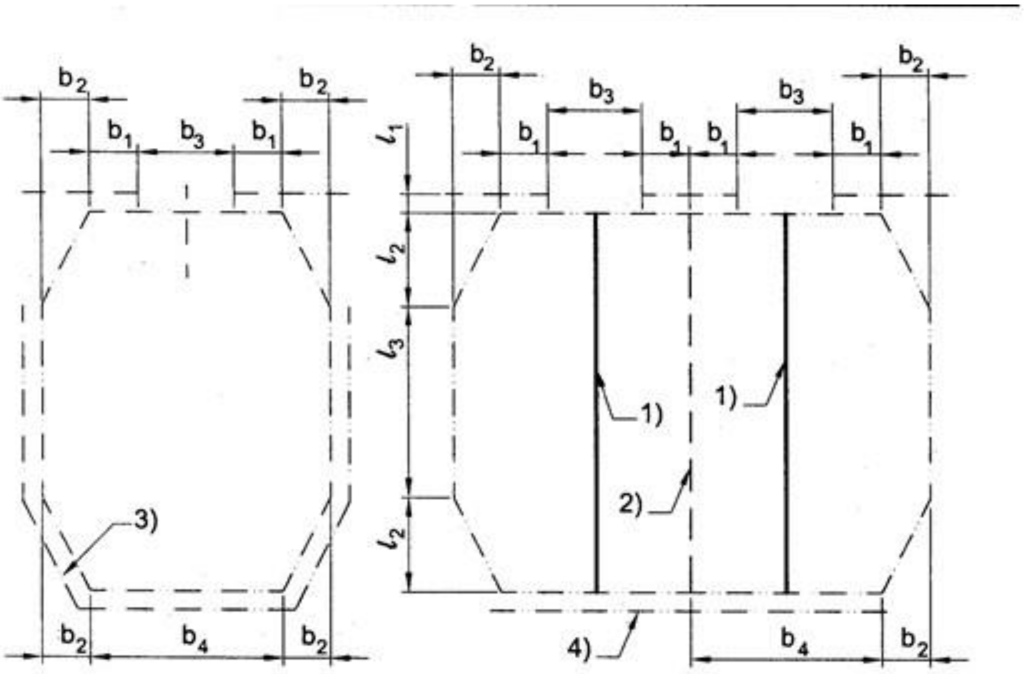
7.3.4.1 The relationship between falling distance (from slide outlet to water level) and water depth shall be in accordance with Table 3.

7.3.4.2 The minimum water depth shall be conventionally measured over an area corresponding to the width b, $b_1 + b$, (*see* Tables 4 to 7 read with figures) centered with the sliding outlet from the sliding outlet to 2 m away in direction of sliding.

Table 3 Falling Distance and Water Depth
(*Clause* 7.3.2.2, 7.3.3.3 *and* 7.3.4.1)

Sl. No.	**Falling Distance, *d*** mm	**Water Depth** mm
(1)	(2)	(3)
i)	$0 < d \leq 200$	100 *Min* 800 *Min*, 1 200 *Max* for (Types 1 and 2)
ii)	600	1 800 *Min*
iii)	1 500	4 500 *Min*
iv)	> 1 500	4 500 *Min*

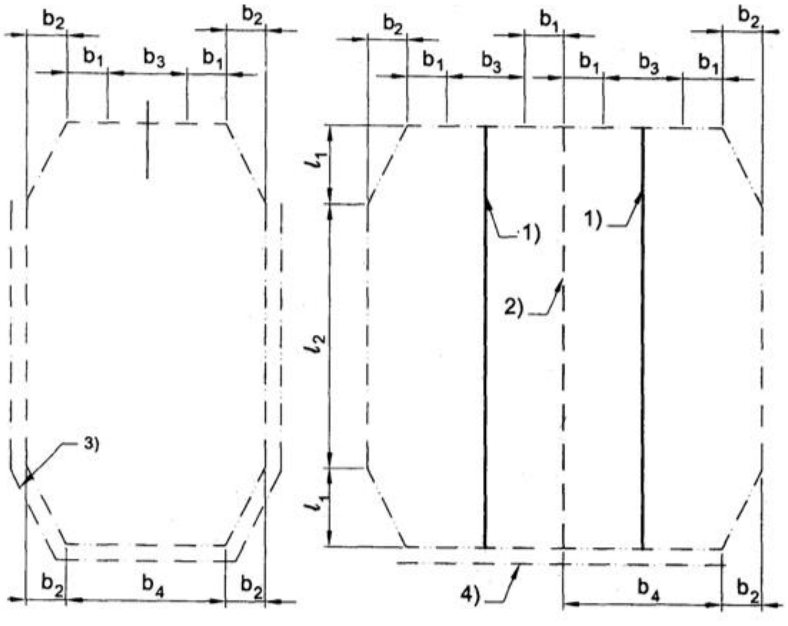
NOTE — Intermediate values to be interpolated linearly.



1) Centreline marking in contrasting colours on the floor.
2) Soft floating lines between the tracks.
3) Possible area of stairs or ladder for a single-slide.
4) Possible area of stairs or ladders for slides with final parts entering the same side of the pool.

Table 4 Dimensions of Splashdown Area Types 1 and 2
(*Clauses* 6.8.2, 7.3.2.1, and 7.3.4.2)
All dimensions in millimetres.

Sl. No.	**Dimension**	**Minimum**
(1)	(2)	(3)
i)	l_1	200
ii)	l_2	1 000
iii)	l_3	2 000
iv)	b_1	500
v)	b_2	500
vi)	b_3	Slide width
vii)	b_4	b_3+2b_1



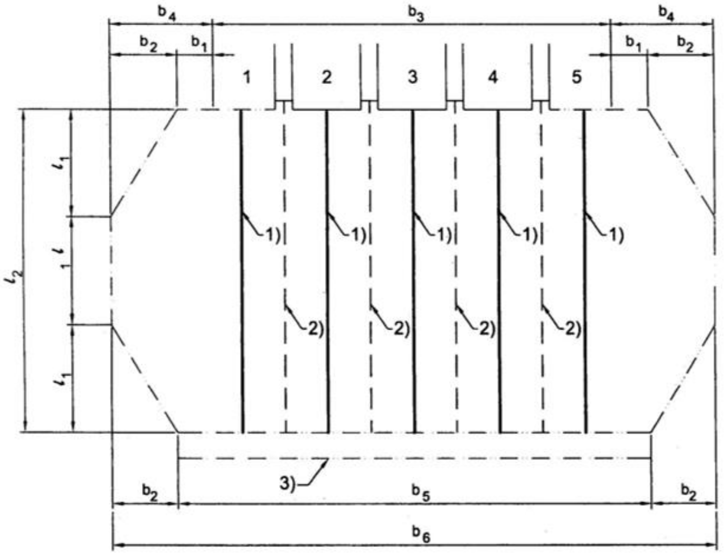
1) Centreline marking in contrasting colours on the floor.
2) Soft floating lines between the tracks.
3) Possible area of stairs or ladder for a single-slide.
4) Possible area of stairs or ladders for slides with final parts entering the same side of the pool.

Table 5 Dimensions of Splashdown Area Types 3, 4 and 5

(*Clauses* 6.8.2, 7.3.2.1, and 7.3.4.2)

All dimensions in millimetres

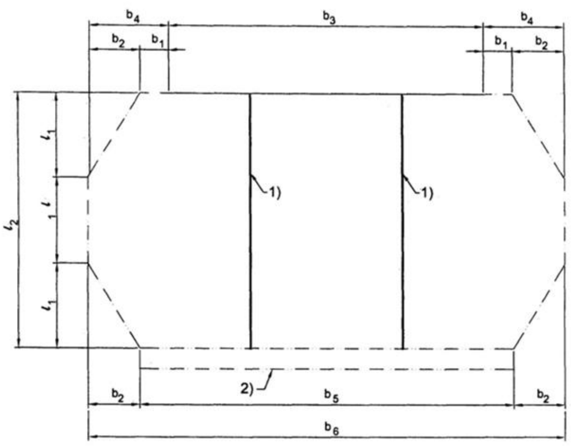
Sl. No.	**Dimension**	**Type**	
		3 **Minimum**	**4/5** **Minimum**
(1)	(2)	(3)	(4)
i)	l_1	2 000	2 000
ii)	l_2	2 000	6 000
iii)	b_1	500	500
iv)	b_2	1 000	1 000
v)	b_3	Slide width	Slide width
vi)	b_4	b_3+2b_1	b_3+2b_1



1 and 5 — Sidetracks.
2 to 4 — Intermediate tracks.
1) Centreline marking in contrasting colours on the floor.
2) Soft floating lines between the tracks.
3) Possible area of stairs or ladder for a single-slide.

Table 6 Dimensions of Splashdown Area Type 6
(*Clauses* 6.8.2 and 7.3.4.2)
All dimensions in millimetres

Sl. No. (1)	**Dimension** (2)	**Minimum** (3)
i)	l_1	2 000
ii)	l_2	$3\times l_1$
iii)	b_1	500
iv)	b_2	1 000
v)	b_3	Width of Type 6
vi)	b_4	b_1+b_2
vii)	B_5	b_3+2b_1
viii)	B_6	b_3+2b_4



1) Centreline marking in contrasting colours on the floor (minimum)
2) Possible area of stairs or ladders.

Table 7 Dimensions of Splashdown Area Type 7
(*Clause* 7.3.2.1 *and* 7.3.4.2)
All dimensions in millimetres.

Sl. No. (1)	**Dimension** (2)	**Minimum** (3)
i)	l_1	2 000
ii)	l_2	$3 \times l_1$
iii)	b_1	500
iv)	b_2	1 000
v)	b_3	Width of Type 7
vi)	b_4	b_1+b_2
vii)	b_5	b_3+2b_1
viii)	b_6	b_3+2b_4

7.4 Water Flow

The inlet of the water shall not be later than the start section. Water flow rate shall be as follows:

a) At least 3 l/min for Type 1;
b) At least 40 l/min for Type 2;
c) At least 1000 l/min for Types 3, 4, and 5;
d) At least 300 l/min for each track of Type 6; and
e) At least 300 l/min/m of width for Type 7.

7.5 Clearance Zones

Clearance zones shall conform to Fig. 13. Fixed objects and structures shall not be placed within the clearance zones. Unavoidable components can be placed between 650 mm and 850 mm from line X, provided with a suitable guard, smooth and free of irregularities, with edges rounded to a minimum radius of 100 mm (*see* Fig. 2).

8 STRUCTURAL DESIGN OF WATER SLIDES

8.1 This section defines the loading and strength criteria that shall be used in the structural engineering of water slide flumes and supporting structures. The strength and stability of the water slide system shall be demonstrated by generally accepted engineering methods certified by a professional engineer.

8.2 Dead Loads (DL)

Forces result from the weight of all components of the ride and include all loads that do not fluctuate with respect to time.

8.3 Operational Loads

Forces from water, riders, or vehicles, or a combination thereof, in the ride under normal operations.

8.3.1 *Water Load (WL)*

In free-flowing water slides where water does not collect in pools or streams greater than 50 mm deep, the water load shall be a minimum of 22 kg per linear meter of flow. Where the flow is such that water collects in pools or streams greater than 50 mm deep, the actual maximum water load shall be determined and used in calculation, design, or load tests, or a combination thereof.

8.3.2 *Rider Load (RL)*

The manufacturer shall specify the rider vehicle and the maximum number of riders that are to ride in the flume at one time.

8.3.2.1 For water slides intended for multiple rider use, the weight assigned to each rider shall be, at a minimum, the weight specified for a rider as per **5.4**.

8.3.2.2 For single rider water slides, the rider weight shall be a maximum of 135 kg.

8.3.2.3 Ride loads shall be so arranged to cause the greatest realistic operational load to the system.

8.3.2.4 Lateral centripetal forces shall be considered in curved sections of the flume. Predicted rider speeds should be used to calculate these forces. If speeds cannot be predicted, then a minimum of 15 ft/sec for flumes under 15 percent slope and 30 ft/sec for all other flumes shall be used.

8.3.2.5 If the manufacturer places maximum rider total weight limits on a slide, then that restricted load may be used.

8.3.2.6 The weight of the rider vehicle shall be included in determining rider load.

8.4 Environmental Loads

Forces from environmental conditions of the site such as wind, precipitation, earthquake, and changes in temperature.

8.4.1 Loads and forces due to environmental conditions shall be in accordance with applicable local code requirements.

8.4.2 The manufacturer/designer shall clearly indicate the environmental loads the water slide was designed for in the operating and maintenance. In addition to the environmental load information, any restriction, limitations, or special procedures associated with water slides exposed to these environmental loads shall be included.

8.4.3 *Lateral Wind Load (LWL)*

For outdoor slides, the minimum wind load for all types of water slides shall be calculated based on 160 km/ph wind (3-s gust) for non-operational conditions. Lateral wind load may be reduced by an importance factor of 1.15, where appropriate, for water slide structures that are unoccupied during extreme weather.

8.4.4 *Reduced Lateral Wind Load (RLWL)*

For outdoor slides, the minimum wind load for all types of water slides shall be calculated based on relevant Indian Standards.

8.4.5 *Other Lateral Loads (OLL)*

A minimum lateral load equivalent to 10 percent of the dead weight of the structure shall be included.

8.4.6 *Snow Load (SLY)*

The snow load for all types of water slides shall be calculated in accordance with the relevant local ground snow load(s).

8.5 Overload

Forces from water, riders, or vehicles, or a combination thereof, under extraordinary operational conditions due to user overload.

8.5.1 Calculations for extraordinary operational conditions that consider user overload shall be based on conditions specified by the manufacturer and need not consider any other live load in combination with such overload.

8.6 Load Combinations

Engineering calculations may use either allowable stress methods (ASD) or load and resistance factor methods (LRFD). Engineering calculations shall consider load conditions and combinations of loads in accordance with generally accepted engineering methods. Calculations shall consider that water slide systems may not be occupied during extremes of weather.

8.7 Metal Structures

Strength of steel structures under or above noted loads shall be designed in accordance with the relevant Indian Standards.

8.8 Wood Structures

The strength of timber structures under the above-noted loads shall be designed in accordance with the relevant Indian Standards.

8.9 Concrete Structures

Strength of concrete structures under the above-noted loads shall be designed in accordance with the relevant Indian Standards.

8.10 Plastic and Plastic Composite Structures

8.10.1 Strength of plastic structures under the above-noted loads shall be designed in accordance with generally accepted engineering methods. The assessment shall be performed in a manner suitable for the specific material and structure.

8.10.2 Fiberglass reinforced plastic or other composite materials used structurally shall have samples tested for strength with accelerated aging in accordance with relevant Test Methods.

8.10.3 Loads from normal operational conditions shall demonstrate a minimum of 5 factor of safety against rupture for fiberglass reinforced plastic or other composite materials.

8.10.4 Calculations for extraordinary operational conditions from user overload shall demonstrate a minimum of 2 factor of safety against rupture of fiberglass reinforced plastic or other composite materials.

9 TEST METHODS

9.1 Technical test the safety requirements specified at **6** and **7** shall be tested using the most appropriate method, for example, visual or tactile examination, or measurement tests.

9.2 Practical Test

9.2.1 *General*

With this test, the requirements of **6.6**, **6.7.1**, **6.10.2**, **6.12**, **6.13,** and **7.2** and the average speed are tested, carrying out the test at the same time and as part of commissioning. Carry out the test with one or more slide experts. Where the slide expert is not appointed by regulation then the appointment shall be by agreement between the supplier and the client.

9.2.2 *Slide Expert*

The slide expert shall be bodily fit, wearing a bathing costume.

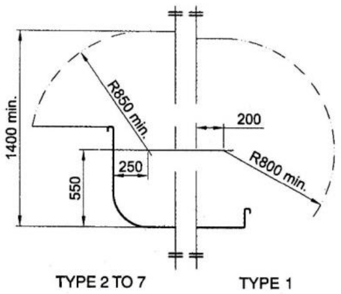
9.2.3 *Procedure*

In certain circumstances (for example, special features) a preliminary test carried out by use of a test body (for example, a water bag made of plasticized fabric with amass of approximately 30 kg to 35 kg with a length of approximately 900 mm and a diameter of approximately 350 mm) could be necessary.

9.3 *Test Report*

The test report shall include at least the following information:

a) Name and address of the examining body and where the test was carried out;
b) Unique identification of test report (such as a serial number) and of each page, and the total number of pages of the test report;
c) Name and address of the client;
d) Description and identification of the test item;
e) Date(s) of examination;
f) Identification of the test specification or description of the method or procedure;
g) Any deviations, additions, or exclusions from the test specification, and any other information relevant to a specific test;
h) Identification of any non-standard test method or procedure utilized;
j) Measurements, examinations, and derived results, supported by tables, graphs, sketches, and photographs as appropriate, and any failures identified;
k) Statement on measurement uncertainty (where relevant);
m) A statement that all the requirements specified at **7** and **8** have been fulfilled;
n) Signature and title or an equivalent marking of the person(s) accepting technical responsibility for the test report and date of issue; and
p) Statement to the effect that the test results relate only to the items tested.



All dimensions in millimetres.
FIG. 13 CLEARANCE ZONE

FIG. 9 CLEARANCE ZONE

9.4 Product Testing Standards

Appearance Quality

a) Water slides inner surface smooth, uniform colour, and meet the design requirements;
b) Water slides no bubbles, cracks, pits, scratches, and other defects;
c) Water slides outer surface should be no burr;
d) Water slides fiberglass cloth joints uniform colour;
e) Water slides flange edge cut flat;
f) Water slides geometric dimensions meet the design requirements (include outdoor water slide length, depth, width, and thickness);

g) Water slides sectional shape without significant deformation flexure.

10 DESIGNATION AND MARKING

10.1 Designation

The designation consists of following:

a) The description block (short description of the product); and
b) The identity block, consisting of:
    1) Indian Standard number block; and
    2) Individual item block (coding of the item and variable figures). The number indicating the type in **2.1** (if any) shall be used for coding.

Example:

Designation of a water slide not restricted in height with an average inclination of the maximum of 1 to 3percent (Type 3), a height of 8 m, and a length of 80 m;

Water slide IS 15492-3-8-80

10.2 Marking

Water slides should be marked in a legible and durable manner in the English in which the water slide is installed, in a position conspicuous and accessible (for example, at the entrance of the means of access) after installation with the following indications:

a) Name and/or logo and the address of the manufacturer, supplier, importer, or installer;
b) Year of installation; and
c) Designation.

11 Water Slide Rules

a) Keep all glass, bottles, and food away from pools.
b) No running, standing, kneeling, rotating, or tumbling in flumes or tunnels.
c) Stopping, changing position, and forming ‘‘chains’’ are prohibited.
d) Slide feet first, on your back, or in a sitting position.
e) Keep hands inside the flume.
f) No diving from flume at any time.
g) Never use this slide when under the influence of alcohol or drugs.
h) Follow the instructions of the attendant and/or lifeguard at all times.
j) Leave the landing pool promptly after exiting from the slide.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Continuous Bulk Conveying, Elevating, Hoisting Aerial Ropeways and Related Equipment Sectional Committee, MED 06

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